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PATENT APPLICATION/PCT
Attorney Docket No. 1217-012124

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of :
Hachirou KUSHIDA : TABLEWARE, PROCESS FOR SURFACE
Yutaka FUKUMURA : TREATMENT THEREOF, SUBSTRATE
Yukio MIYA : HAVING HARD DECORATIVE COATING
FILM, PROCESS FOR PRODUCING THE
International Application : SUBSTRATE, AND CUTLERY
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Pittsburgh, Pennsylvania
December 19, 2001

PRELIMINARY AMENDMENT

Box PCT
Commissioner for Patents
Washington, D.C. 20231

Sir:

IN THE SPECIFICATION:

Please insert, amend and delete section headings and amend specification paragraphs as follows.

On page 1, at line 8, please insert the following section heading:

BACKGROUND OF THE INVENTION

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Please replace the paragraph beginning at page 1, line 10 with the following rewritten paragraph:

The present invention relates to tableware or flatware (cutter, and cutlery such as a knife, fork and spoon, as well as related serving pieces) and a process for surface treatment of the tableware. More particularly, the invention relates to titanium or titanium alloy tableware, the surface of which has been hardened by surface treatment, and a process for surface treatment of the tableware.

Please delete the section heading "OBJECT OF THE INVENTION" which begins on page 6, at line 8.

Please replace the paragraph beginning at page 6, line 9 with the following rewritten paragraph:

The present invention solves the problems associated with the prior art as described above and provides titanium or titanium alloy tableware having excellent appearance quality, which is capable of maintaining its beautiful mirror surface even if it is used for a long period of time, by the formation of a hardened layer which extends into a deep region beneath the surface.

Please replace the paragraph beginning at page 6, line 16 with the following rewritten paragraph:

The invention further provides a process for surface treatment with high productivity, which is applied on titanium or titanium alloy tableware to impart the above-mentioned excellent appearance quality to the tableware.

Please replace the paragraph beginning at page 6, line 21 with the following rewritten paragraph:

Still further, the invention solves the problems associated with the prior art as described above by providing a substrate having a hard decorative coating film, which is free

from the occurrence of marring on the decorative coating film and formation of irregularities on the substrate surface even if a strong force is applied to the coating film surface, wherein the coating film resists separation. The invention also provides a process for producing the substrate.

Please replace the paragraph beginning at page 7, line 3 with the following rewritten paragraph:

The invention further provides a titanium or titanium alloy substrate coated with a hard decorative coating film having a durable, beautiful surface even after long periods of use which retains its excellent quality and appearance.

Please replace the paragraph beginning at page 7, line 8 with the following rewritten paragraph:

In view of the problems associated with the prior art as described above, it is a further object of the invention to provide cutlery which is lightweight, likely to float on water, has an easy grip and a good touch, and is decorative and inexpensive.

Please replace the paragraph beginning at page 7, line 13 with the following rewritten paragraph:

It is a further object of the invention to make it possible to wash the present cutlery easily by providing buoyancy to the cutlery so as to permit it to float on water.

Please replace the section heading beginning at page 7, line 17 with the following rewritten section heading:

SUMMARY OF THE INVENTION

Please replace the paragraph beginning at page 7, line 21 with the following rewritten paragraph:

wherein the surface hardened layer comprises a first hardened layer which is formed in the region of an arbitrary depth from the surface and in which nitrogen and oxygen are

diffused so as to form a solid solution, and a second hardened layer which is formed in an arbitrary region deeper than the first hardened layer.

Please replace the paragraph beginning at page 18, line 14 with the following rewritten paragraph:

Fig. 1 is a graph showing results of the measurements of Vickers hardness versus treating temperature of a member having been surface hardened by the process for surface treatment of tableware according to the invention.

Please replace the paragraph beginning at page 18, line 26 with the following rewritten paragraph:

Fig. 4 is a graph showing results of the measurements of a nitrogen content and an oxygen content to a depth from the surface of titanium or titanium alloy tableware in the first embodiment of the tableware according to the invention and the process for surface treatment thereof.

Please replace the paragraph beginning at page 19, line 4 with the following rewritten paragraph:

Fig. 5 is a graph showing results of the measurements of a nitrogen content and an oxygen content to a depth from the surface of titanium or titanium alloy tableware in the second embodiment of the tableware according to the invention and the process for surface treatment thereof.

Please replace the paragraph beginning at page 20, line 21 with the following rewritten paragraph:

Fig. 16 is a graph showing results of the measurement of Vickers hardness versus treating temperature of a member having been surface hardened, in the substrate having a hard decorative coating film according to the invention and the process for producing the same.

Please replace the paragraph beginning at page 21, line 7 with the following rewritten paragraph:

Fig. 19 is a graph showing results of the measurements of a nitrogen content and an oxygen content to a depth from the surface of a substrate in the first embodiment of the substrate having a hard decorative coating film according to the invention and the process for producing the same.

Please replace the paragraph beginning at page 21, line 12 with the following rewritten paragraph:

Fig. 20 is a graph showing results of the measurements of a nitrogen content and an oxygen content to a depth from the surface of a substrate in the second embodiment of the substrate having a hard decorative coating film according to the invention and the process for producing the same.

Please replace the section heading beginning at page 24, line 10 with the following rewritten section heading:

DETAILED DESCRIPTION OF THE INVENTION

Please delete the section heading "EFFECT OF THE INVENTION" which begins on page 141 at line 27.

IN THE CLAIMS:

Please amend claim 4 as follows:

4. A process for surface treatment of tableware, comprising:

heating titanium or titanium alloy tableware in a vacuum chamber to anneal the tableware,

hardening the tableware by introducing a mixed gas containing nitrogen as a main component and an oxygen component into the vacuum chamber after the heating to anneal step, and further heating the vacuum chamber at a temperature of 700 to 800°C for a given period of

time under a given reduced pressure to diffuse nitrogen and oxygen inside the titanium or titanium alloy tableware from the surface so as to form a solid solution,

cooling the titanium or titanium alloy tableware to room temperature after the hardening treatment step, and

polishing the tableware after the cooling step.

Please amend claim 14 as follows:

14. A process for surface treatment of tableware, comprising:

placing titanium or titanium alloy tableware in a vacuum chamber, evacuating the vacuum chamber, then introducing an inert gas into the vacuum chamber, and heating the tableware under reduced pressure to anneal the tableware,

hardening the tableware by evacuating the vacuum chamber to remove the inert gas after the heating to anneal step, then introducing a mixed gas containing nitrogen as a main component and an oxygen component into the vacuum chamber, adjusting the pressure in the vacuum chamber to atmospheric pressure, and further heating the vacuum chamber to a temperature of 700 to 800°C for a given period of time to diffuse nitrogen and oxygen inside the titanium or titanium alloy tableware from the surface so as to form a solid solution,

cooling the titanium or titanium alloy tableware to room temperature after the hardening treatment step, and

polishing the tableware after the cooling step.

Please amend claim 21 as follows:

21. The tableware as claimed in claim 1, wherein the first hardened layer is coated with a hard coating film.

Please amend claim 23 as follows:

23. The tableware as claimed in claim 21, wherein the hard coating film shows a gold color tone.

Please amend claim 26 as follows:

26. The tableware as claimed in claim 1, wherein the surface of the first hardened layer has been polished.

Please amend claim 34 as follows:

34. The substrate having a hard decorative coating film as claimed in claim 27, wherein the thickness of the hard decorative coating film is in the range of 0.1 to 3.0 μm .

Please amend claim 35 as follows:

35. The substrate having a hard decorative coating film as claimed in claim 27, wherein the surface of the hard decorative coating film shows a gold color tone.

Please amend claim 37 as follows:

37. The substrate having a hard decorative coating film as claimed in claim 27, which is a camera body, a cellular telephone body, a portable radio body, a video camera body, a lighter body or a personal computer main body.

Please amend claim 38 as follows:

38. A process for producing a substrate having a hard decorative coating film, comprising:

heating a substrate comprising titanium or a titanium alloy in a vacuum chamber to anneal the substrate,

hardening the substrate by introducing a mixed gas containing nitrogen as a main component and an oxygen component into the vacuum chamber, and further heating the vacuum chamber to a temperature of 700 to 800°C for a given period of time under given reduced pressure to diffuse nitrogen and oxygen inside the titanium or titanium alloy substrate from the surface so as to form a solid solution,

cooling the titanium or titanium alloy substrate to room temperature,

polishing the substrate surface,

washing the substrate,
placing the substrate in a vacuum chamber and evacuating the vacuum chamber,
introducing argon into the vacuum chamber, ionizing the argon and ion
bombarding the substrate surface,

forming by sputtering an intermediate layer comprising a metal or a metallic
carbide on the substrate surface,

exhausting the argon the vacuum chamber and introducing a gas containing
carbon into the vacuum chamber, and

generating a plasma in the vacuum chamber and forming by plasma CVD
treatment a diamond-like carbon coating film on the surface of the intermediate layer.

Please amend claim 43 as follows:

43. A process for producing a substrate having a hard decorative coating film,
comprising:

heating a substrate comprising titanium or a titanium alloy in a vacuum chamber to
anneal the substrate,

hardening the substrate by introducing a mixed gas containing nitrogen as a main
component and an oxygen component into the vacuum chamber, and heating the vacuum
chamber to a temperature of 700 to 800°C for a given period of time under given reduced
pressure to diffuse nitrogen and oxygen inside the titanium or titanium alloy substrate from the
surface so as to form a solid solution,

cooling the titanium or titanium alloy substrate to room temperature,

polishing a surface of the substrate,

washing the substrate,

placing the substrate in a vacuum chamber and evacuating the vacuum chamber,

introducing argon into the vacuum chamber, ionizing the argon and ion bombarding the substrate surface, and

forming a hard decorative coating film comprising a nitride, a carbide, an oxide, a nitrido-carbide or a nitrido-carbido-oxide of a 4a, 5a or 6a Group element of the periodic table on the substrate surface by ion plating or sputtering.

Please amend claim 45 as follows:

45. Cutlery comprising a working part and a grip, wherein the grip is provided with a floating means.

Please amend claim 49 as follows:

49. Cutlery comprising a working part and a grip,
wherein the working part comprises a titanium material,
the grip comprises a thermoplastic resin having a hollow part, and
the working part is an integrally constituted part formed by insert molding using the thermoplastic resin.

Please amend claim 50 as follows:

50. Cutlery as claimed in claim 45, which is one of a spoon, a fork or a knife.

IN THE ABSTRACT:

Please replace the section heading beginning at page 159, line 1 with the following rewritten section heading:

ABSTRACT OF THE DISCLOSURE

Please replace the paragraph beginning at page 159 line 2 with the following rewritten paragraph:

Tableware of Ti or a Ti alloy having a surface hard layer comprising a first hardened layer in which nitrogen and oxygen are diffused so as to form a solid solution and a second hardened layer which is formed in a region deeper than the first hardened layer. The

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substrate may have a hard decorative coating film . A substrate comprising Ti or a Ti alloy has on its surface an internal hardened layer comprising a first hardened layer and a second hardened layer, wherein the hard decorative coating film is formed on the surface of the internal hardened layer. The cutlery comprises a working part and a grip, and the grip is provided with a floating means such as a hollow part. Titanium tableware having excellent long-term mar resistance and high quality appearance quality is provided, and the decorative value of the tableware can be increased. Further, a process for surface treatment to obtain the titanium tableware with high productivity is provided, as well as a substrate having a hard decorative coating film, which shows excellent mar resistance and high surface hardness. Since the cutlery floats in water, contact of cutlery with one another hardly takes place. Therefore, the cutlery is not marred easily. Moreover, the cutlery is lightweight and can be easily handled.

REMARKS

The specification and claims have been amended to place the application in conformance with standard United States patent practice.

Attached hereto is a marked-up version of the changes made to the specification by the current amendment. The attachment is captioned "VERSION WITH MARKINGS TO SHOW CHANGES MADE".

Examination and allowance of pending claims 1-50 are respectfully requested.

Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the specification:

Paragraph beginning at page 1, line 10 has been amended as follows:

The present invention relates to tableware or flatware (cutter, and cutlery such as a knife, fork and spoon, as well as related serving pieces) and a process for surface treatment of the tableware. More particularly, the invention relates to titanium or titanium alloy tableware, the surface of which has been hardened by surface treatment, and a process for surface treatment of the tableware.

Paragraph beginning at page 6 line 9 has been amended as follows:

~~It is the first object of the~~ The present invention to solve ~~solves~~ the problems associated with the prior art as described above and ~~to provide~~ titanium or titanium alloy tableware having excellent appearance quality, which is capable of maintaining its beautiful mirror surface even if it is used for a long period of time, by the formation of a hardened layer reaching which extends into a deep region from beneath the surface.

Paragraph beginning at page 6, line 16 has been amended as follows:

~~It is the second object of the~~ The invention to provide ~~further provides~~ a process for surface treatment with high productivity, which is applied ~~out-on~~ titanium or titanium alloy tableware to impart the above-mentioned excellent appearance quality to the tableware.

Paragraph beginning at page 6, line 21 has been amended as follows:

~~It is the third object of~~ Still further, the invention ~~to solve~~ the problems associated with the prior art as described above and ~~to provide~~ by providing a substrate having a hard decorative coating film, which is free from the occurrence of marring on the decorative coating film and formation of irregularity-irregularities on the substrate surface even if a strong force is applied to the coating film surface and which can be reduced in separation of the coating film to the utmost, and, wherein the coating film resists separation. The invention also provides a process for producing the substrate.

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Paragraph beginning at page 7, line 3 has been amended as follows:

~~It is the fourth object of the~~ The invention to provide further provides a titanium or titanium alloy substrate coated with a hard decorative coating film having ~~its a~~ durable, beautiful surface even if ~~used for a~~ after long periods of time ~~with use~~ which retains its excellent ~~quality and appearance~~ appearance quality, and to provide a process for producing the substrate.

Paragraph beginning at page 7, line 8 has been amended as follows:

In view of the problems associated with the prior art as described above, it is the ~~fifth a further~~ object of the invention to provide cutlery which is lightweight, likely to float on water, has ~~a an~~ easy grip of easy handling and a good touch, and is decorative and inexpensive.

Paragraph beginning at page 7, line 13 has been amended as follows:

It is ~~the sixth a further~~ object of the invention to make it possible to wash a number of ~~the present~~ cutlery easily by ~~allowing providing~~ buoyancy to the cutlery so as to have properties of floating ~~permit it to float~~ on water.

Section heading beginning at page 7, line 17 has been amended as follows:

DISCLOSURE SUMMARY OF THE INVENTION

Paragraph beginning at page 7, line 21 has been amended as follows:

wherein the surface hardened layer comprises a first hardened layer which is formed in the region of an arbitrary depth from the surface and in which nitrogen and oxygen are diffused so as to form a solid solution, and a second hardened layer which is formed in an arbitrary region deeper than the first hardened layer.

Paragraph beginning at page 18, line 14 has been amended as follows:

Fig. 1 is a ~~view-graph~~ showing results of the measurements of Vickers hardness ~~versus treating temperature~~ of a member having been surface hardened by the process for surface treatment of tableware according to the invention.

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Paragraph beginning at page 18, line 26 has been amended as follows:

Fig. 4 is a ~~view-graph~~ showing results of the measurements of a nitrogen content and an oxygen content to a depth from the surface of titanium or titanium alloy tableware in the first embodiment of the tableware according to the invention and the process for surface treatment thereof.

Paragraph beginning at page 19, line 4 has been amended as follows:

Fig. 5 is a ~~view-graph~~ showing results of the measurements of a nitrogen content and an oxygen content to a depth from the surface of titanium or titanium alloy tableware in the second embodiment of the tableware according to the invention and the process for surface treatment thereof.

Paragraph beginning at page 20, line 21 has been amended as follows:

Fig. 16 is a ~~view-graph~~ showing results of the measurement of Vickers hardness versus treating temperature of a member having been surface hardened, in the substrate having a hard decorative coating film according to the invention and the process for producing the same.

Paragraph beginning at page 21, line 7 has been amended as follows:

Fig. 19 is a ~~view-graph~~ showing results of the measurements of a nitrogen content and an oxygen content to a depth from the surface of a substrate in the first embodiment of the substrate having a hard decorative coating film according to the invention and the process for producing the same.

Paragraph beginning at page 21, line 12 has been amended as follows:

Fig. 20 is a ~~view-graph~~ showing results of the measurements of a nitrogen content and an oxygen content to a depth from the surface of a substrate in the second embodiment of the substrate having a hard decorative coating film according to the invention and the process for producing the same.

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Section heading beginning at page 24, line 10 has been amended as follows:

BEST MODE FOR CARRYING OUT DETAILED DESCRIPTION OF THE INVENTION

In the claims:

Claim 4 has been amended as follows:

4. A process for surface treatment of tableware, comprising:

~~a heating step wherein titanium or titanium alloy tableware is placed in a vacuum chamber and heated to anneal the tableware,~~

~~a hardening treatment step wherein the tableware by introducing a mixed gas containing nitrogen as a main component and an oxygen component is introduced into the vacuum chamber after the heating to anneal step, and further heating the vacuum chamber is heated at a temperature of 700 to 800°C for a given period of time under a given reduced pressure to diffuse nitrogen and oxygen inside the titanium or titanium alloy tableware from the surface so as to form a solid solution,~~

~~a cooling step wherein the titanium or titanium alloy tableware is cooled to room temperature after the hardening treatment step, and~~

~~a polishing step wherein the tableware is polished after the cooling step.~~

Claim 14 has been amended as follows:

14. A process for surface treatment of tableware, comprising:

~~a heating step wherein placing titanium or titanium alloy tableware is placed in a vacuum chamber, evacuating the vacuum chamber is evacuated, then introducing an inert gas is introduced into the vacuum chamber, and heating the tableware is heated under reduced pressure to anneal the tableware,~~

~~a hardening treatment step wherein the tableware by evacuating the vacuum chamber is evacuated to remove the inert gas after the heating to anneal step, then introducing a mixed gas containing nitrogen as a main component and an oxygen component is introduced into the vacuum chamber, adjusting the pressure in the vacuum~~

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chamber is ~~adjusted~~ to atmospheric pressure, and further heating the vacuum chamber is heated ~~at to~~ a temperature of 700 to 800°C for a given period of time to diffuse nitrogen and oxygen inside the titanium or titanium alloy tableware from the surface so as to form a solid solution,

a ~~cooling step wherein the titanium or titanium alloy tableware is cooled to room~~ temperature after the hardening treatment step, and

a ~~polishing step wherein the tableware is polished after the cooling step.~~

Claim 21 has been amended as follows:

21. The tableware as claimed in ~~any one of claims 1 to 3~~ claim 1, wherein the first hardened layer is coated with a hard coating film.

Claim 23 has been amended as follows:

23. The tableware as claimed in claim 21 ~~or 22~~, wherein the hard coating film shows a gold color tone.

Claim 26 has been amended as follows:

26. The tableware as claimed in ~~any one of claims 1 to 3~~ claim 1, wherein the surface of the first hardened layer has been polished.

Claim 34 has been amended as follows:

34. The substrate having a hard decorative coating film as claimed in ~~any one of claims 27, 30 and 31~~ claim 27, wherein the thickness of the hard decorative coating film is in the range of 0.1 to 3.0 μm .

Claim 35 has been amended as follows:

35. The substrate having a hard decorative coating film as claimed in ~~any one of claims 27, 30 and 34~~ claim 27, wherein the surface of the hard decorative coating film shows a gold color tone.

Claim 37 has been amended as follows:

37. The substrate having a hard decorative coating film as claimed in ~~any one~~ of ~~claims 27, 28 and 29~~ claim 27, which is a camera body, a cellular telephone body, a portable radio body, a video camera body, a lighter body or a personal computer main body.

Claim 38 has been amended as follows:

38. A process for producing a substrate having a hard decorative coating film, comprising:

~~a heating step wherein a substrate comprising titanium or a titanium alloy is placed in a vacuum chamber and annealed~~ to anneal the substrate,

~~a hardening treatment step wherein the substrate by introducing a mixed gas containing nitrogen as a main component and an oxygen component is introduced into the vacuum chamber, and further heating the vacuum chamber is heated at to a temperature of 700 to 800°C for a given period of time under given reduced pressure to diffuse nitrogen and oxygen inside the titanium or titanium alloy substrate from the surface so as to form a solid solution,~~

~~a cooling step wherein the titanium or titanium alloy substrate is cooled to room temperature,~~

~~a polishing step wherein the substrate surface is polished,~~

~~a washing step wherein the substrate is washed,~~

~~an evacuation step wherein placing the substrate is set in a vacuum chamber and evacuating the vacuum chamber is evacuated,~~

~~an ion bombardment step wherein introducing argon is introduced into the vacuum chamber, ionizing the argon and ionized to ion bombard bombarding the substrate surface,~~

~~a step wherein forming by sputtering an intermediate layer comprising a metal or a metallic carbide is formed on the substrate surface by sputtering,~~

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~~a step wherein exhausting the argon is exhausted from the vacuum chamber and introducing a gas containing carbon is introduced into the vacuum chamber, and~~

~~a step wherein generating a plasma is generated in the vacuum chamber and forming by plasma CVD treatment a diamond-like carbon coating film is formed on the surface of the intermediate layer by plasma CVD treatment.~~

Claim 43 has been amended as follows:

43. A process for producing a substrate having a hard decorative coating film, comprising:

~~a heating step wherein a substrate comprising titanium or a titanium alloy is placed in a vacuum chamber and annealed to anneal the substrate,~~

~~a hardening treatment step wherein the substrate by introducing a mixed gas containing nitrogen as a main component and an oxygen component is introduced into the vacuum chamber, and heating the vacuum chamber is heated at to a temperature of 700 to 800°C for a given period of time under given reduced pressure to diffuse nitrogen and oxygen inside the titanium or titanium alloy substrate from the surface so as to form a solid solution,~~

~~a cooling step wherein the titanium or titanium alloy substrate is cooled to room temperature,~~

~~a polishing step wherein a surface of the substrate surface is polished,~~

~~a washing step wherein the substrate is washed,~~

~~an evacuation step wherein placing the substrate is set in a vacuum chamber and evacuating the vacuum chamber is evacuated,~~

~~an ion bombardment step wherein introducing argon is introduced into the vacuum chamber, ionizing the argon and ionized to ion bombard bombarding the substrate surface, and~~

~~a step wherein forming a hard decorative coating film comprising a nitride, a carbide, an oxide, a nitrido-carbide or a nitrido-carbido-oxide of a 4a, 5a or 6a Group~~

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element of the periodic table is ~~formed on~~ the substrate surface by ion plating or sputtering.

Claim 45 has been amended as follows:

45. Cutlery (~~metallic Western style tableware~~) comprising a working part (~~cutlery body~~) and a grip, wherein the grip is provided with a floating means.

Claim 49 has been amended as follows:

49. Cutlery (~~metallic Western style tableware~~) comprising a working part (~~cutlery body~~) and a grip,

wherein the ~~cutlery body~~ working part comprises a titanium material,

the grip comprises a thermoplastic resin having a hollow part, and

the working part is an integrally constituted part formed by insert molding using the thermoplastic resin.

Claim 50 has been amended as follows:

50. Cutlery as claimed in ~~any one of claims 45 to 49~~ claim 45, which is one of a spoon, a fork or a knife.

In the abstract:

The section heading beginning at page 159, line 1 has been amended as follows:

ABSTRACT OF THE DISCLOSURE

Paragraph beginning at page 159 line 2 has been amended as follows:

~~The tableware according to the invention comprises~~ Tableware of Ti or a Ti alloy ~~and has~~ having a surface hard layer comprising a first hardened layer ~~which is formed in the region of an arbitrary depth from the surface and in which nitrogen and oxygen are diffused so as to form a solid solution and a second hardened layer which is formed in an arbitrary a region deeper than the first hardened layer.~~ ~~The purpose of the process for surface treatment of tableware according to the invention is to form the surface hard layer.~~ The substrate ~~having~~ may have a hard decorative coating film ~~according to the invention is a.~~ A substrate comprising Ti or a Ti alloy and having ~~has~~ on its surface an internal

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